Mitigating the effects of shading on the power output of a solar module.

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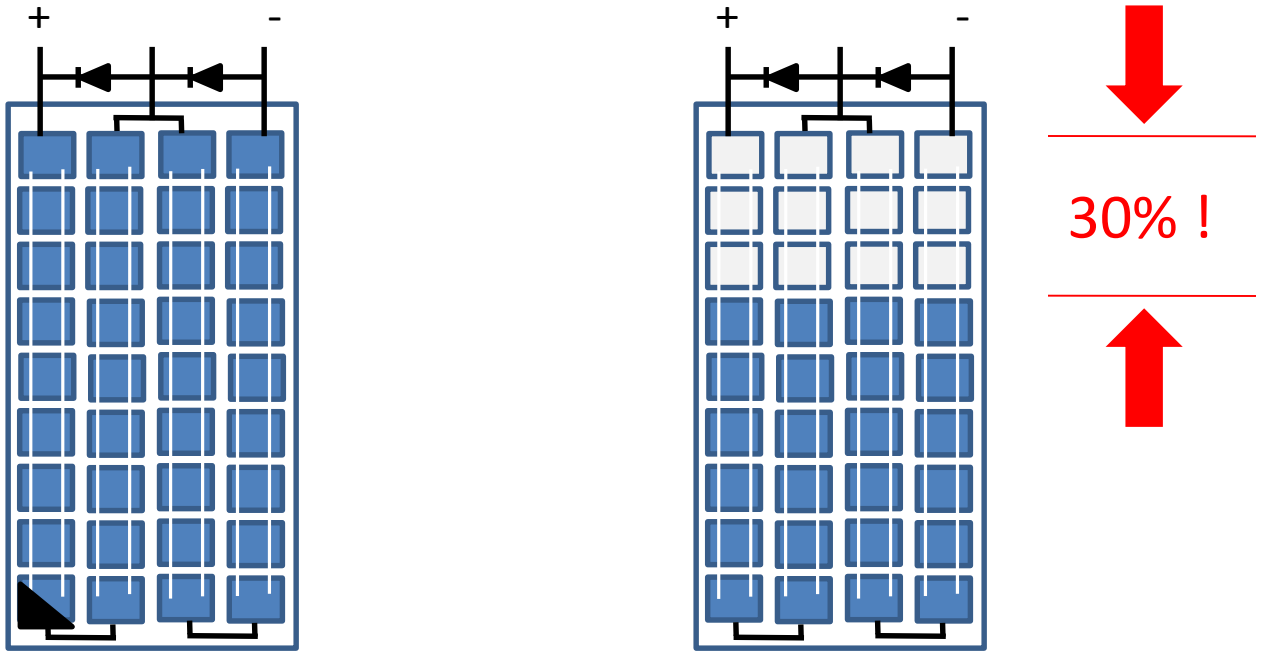
Contents

Background/Justification

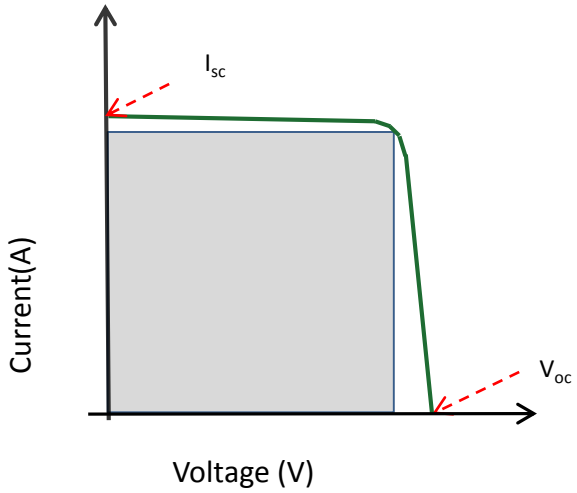
- A loss in power output of at least 30% results from shading of $\frac{1}{2}$ a single cell in a crystalline solar panel made up of 36 cells.



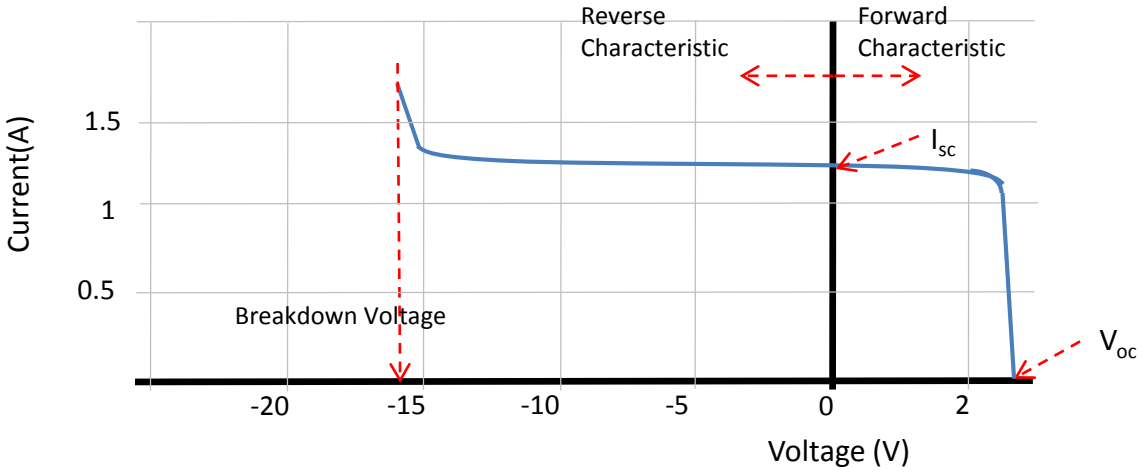
Background/Justification

Background/Justification

Current/Voltage characteristic of a solar cell

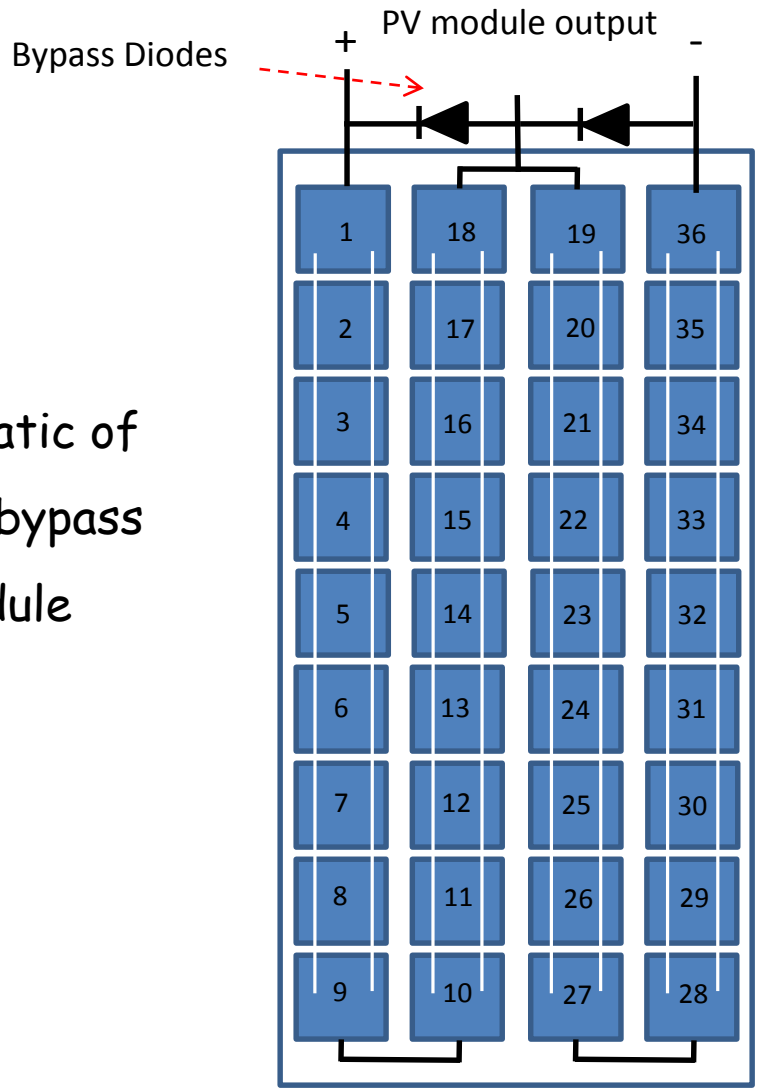


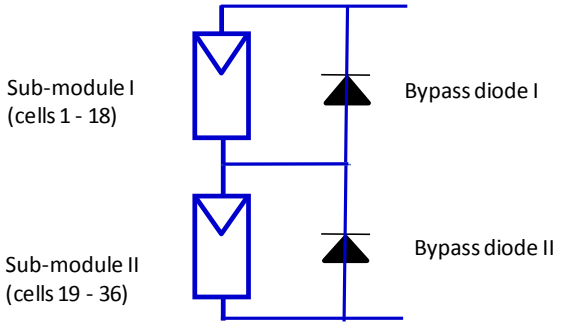
Current/Voltage characteristic of a solar cell in the whole voltage range



Background/Justification

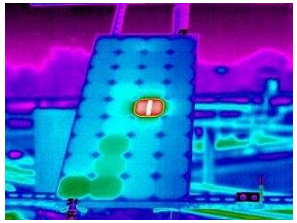
Connection schematic of the solar cell and bypass diodes in a PV module

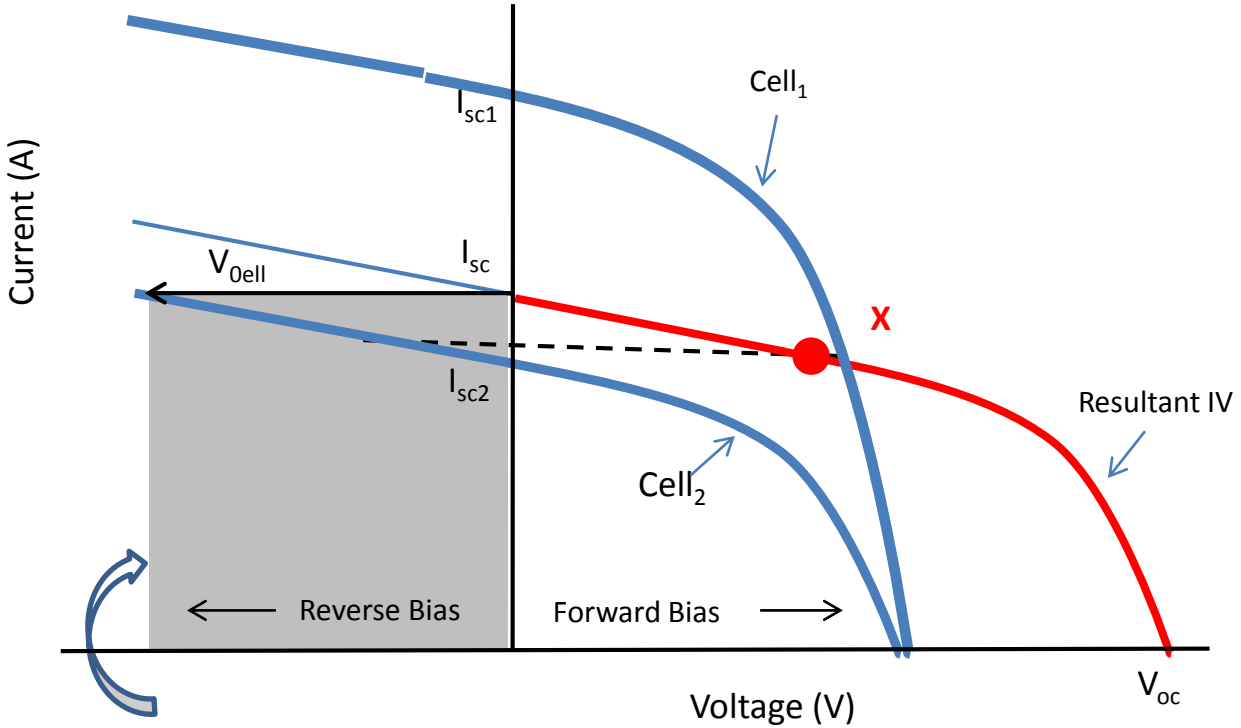




Background/Justification

Hot spot formation

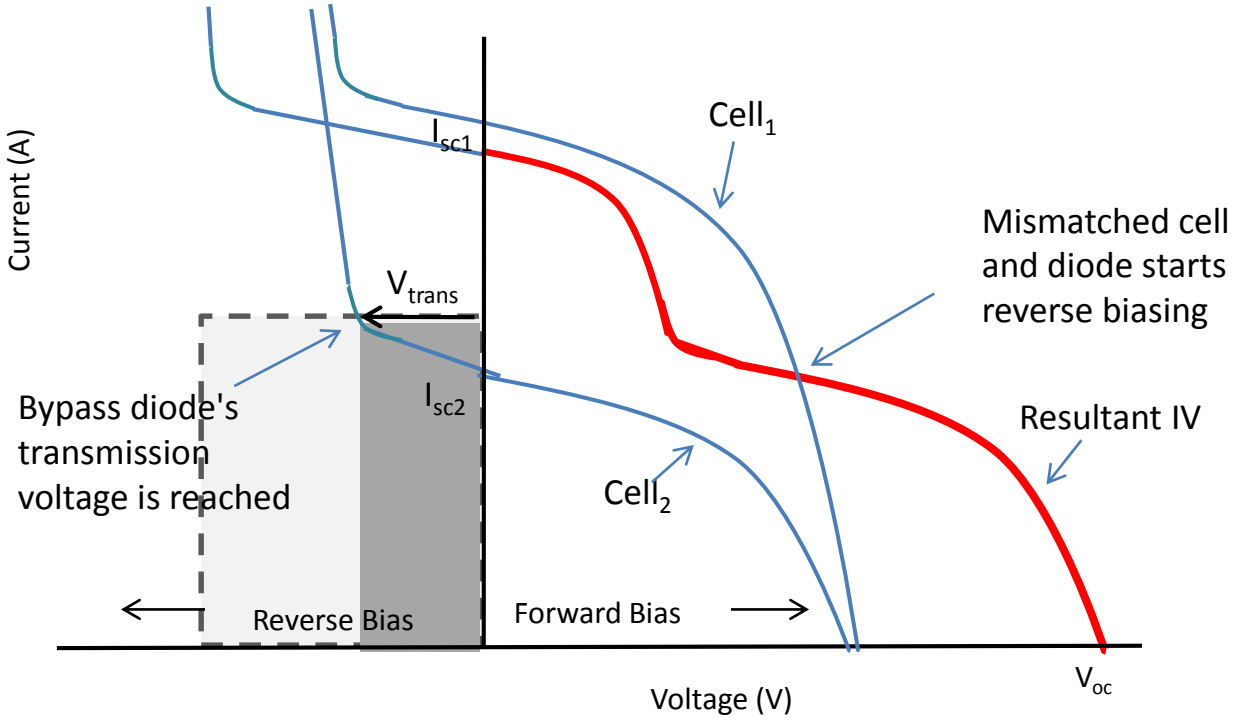




Power dissipated by a mismatched cell

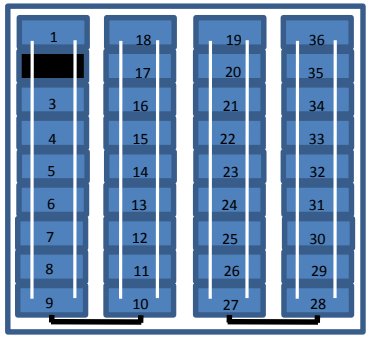
Background/Justification

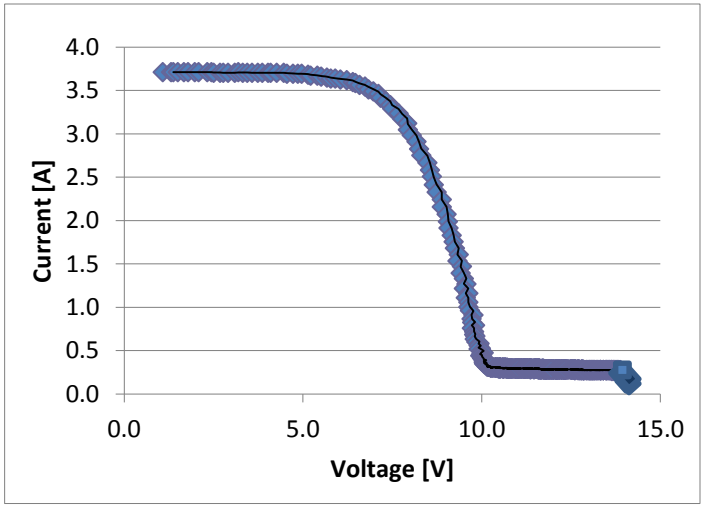
Series connection of two cells with shunt diodes



Background/Justification

Current-voltage characteristic of panel with "hard" shaded cell





Problem Statement

Current solutions on the effects of shading do not offer remedies for single panel solar home systems that are commonplace in rural Africa .

Research Objectives

MAIN OBJECTIVE:

Enhance the energy yield from a conventional 36-cell solar photovoltaic module operating under partially shaded conditions.

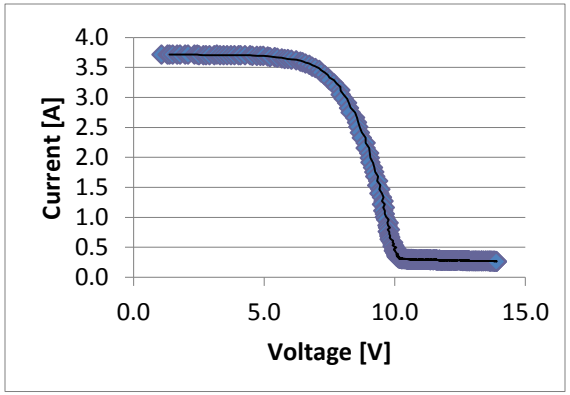
OBJECTIVES

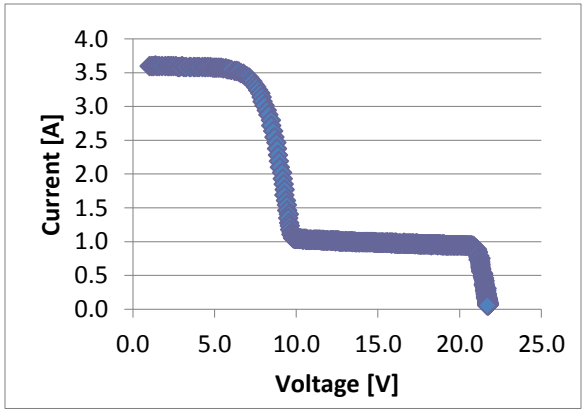
1. Characterize the power output from a conventional 36-cell solar photovoltaic module subjected to various shade profiles.
2. Boost the voltage from a partially shaded sub-module and safely add it to the voltage produced by an un-shaded sub-module.
3. Design shade detection device to sense the voltages from two sub-modules that are subjected to various shade conditions.

OBJECTIVE 1

Characterize the power output from a conventional 36-cell solar photovoltaic module subjected to various shade profiles.

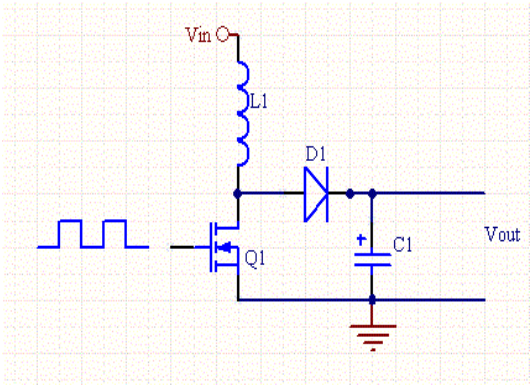
PRELIMINARY RESULTS





OBJECTIVE 2:

BOOST THE VOLTAGE FROM A PARTIALLY SHADED SUB-MODULE



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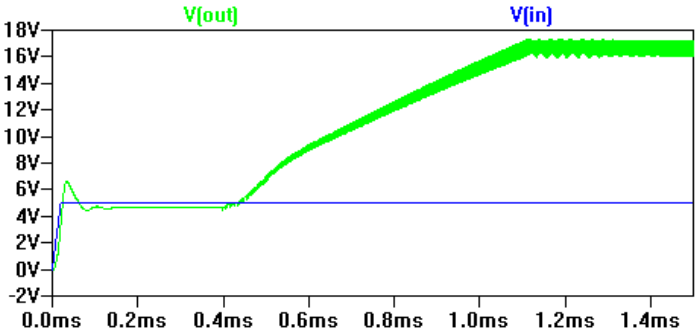
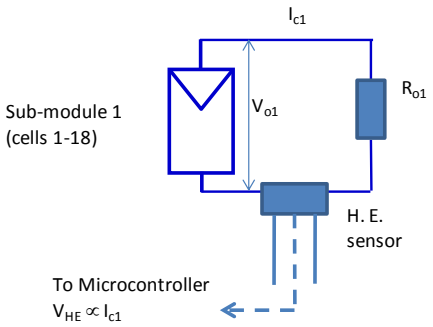


OBJECTIVE 3

SHADE DETECTION DEVICE



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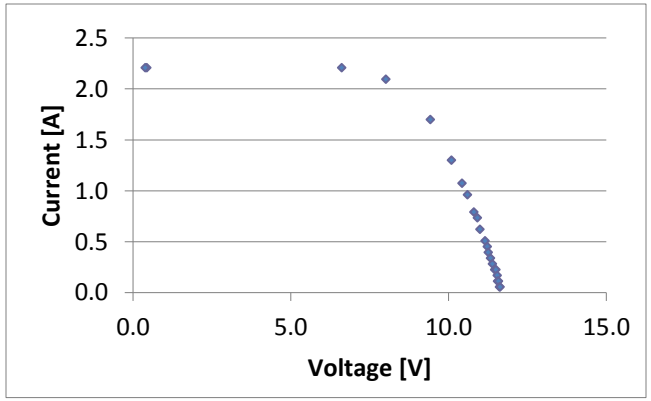

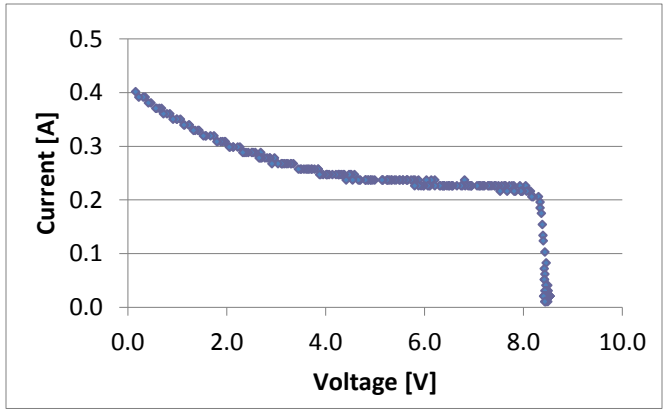

Questions to be discussed

What is the feasibility of carrying out the research on 4 sub-modules comprising of 9 cells each, or on 6 sub-modules comprising of 6 cells each, or on 18 sub-modules of 2 cells each and finally each of the 36 cells in the module?

Thank you